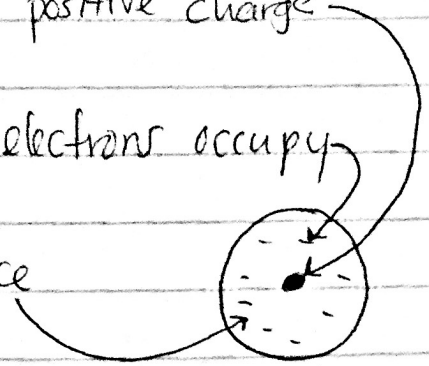
CHM129
Problem Set #2

① (a) Most of the mass and all of the positive charge reside in the nucleus.

(b) The light and negatively charged electrons occupy the space outside the nucleus.

(c) Most of the atom is empty space



②

Symbol	$^{35}_{17}Cl^{1-}$	$^{40}_{20}Ca^{2+}$	$^{84}_{36}Kr$	$^{33}_{15}P$
Protons	17	20	36	15
Neutrons	18	20	48	18
Electrons	18	18	36	15
Atomic Number	17	20	36	15
Mass Number	35	40	84	33
Charge	-1	+2	0	0

③ $$\frac{348\ kJ}{mol}\left(\frac{1\ mol\ photons}{6.022\times10^{23}\ photons}\right)\left(\frac{1000\ J}{1\ kJ}\right) = 5.78\times10^{-19}\ J \text{ per photon}$$
(energy of one photon)

$$E = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{hc}{E} = \frac{(6.626\times10^{-34}\ J\cdot s)(3.00\times10^{8}\ m/s)}{5.78\times10^{-18}\ J}$$

$$\lambda = 3.44\times10^{-7}\ m\left(\frac{1\ nm}{10^{-9}\ m}\right) = 344\ nm$$

⇑

Ultraviolet Radiation

④ (a) emission
(b) absorption
(c) absorption
(d) emission

⑤ $E_3 = -2.18 \times 10^{-18}\,J \left(\frac{1}{3^2}\right) = -2.42 \times 10^{-19}\,J$

$E_5 = -2.18 \times 10^{-18}\,J \left(\frac{1}{5^2}\right) = -8.72 \times 10^{-20}\,J$

$\Delta E = E_{final} - E_{initial} = E_{photon}$

$= (-2.42 \times 10^{-19}\,J) - (-8.72 \times 10^{-20}\,J) = -1.55 \times 10^{-19}\,J$

(−) means energy is lost (emitted) as light.

$E = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{hc}{E} \Leftarrow = \Delta E$

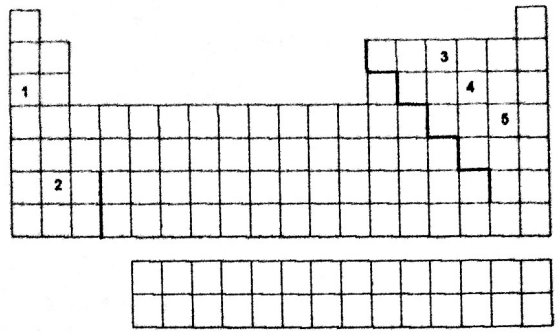
$\lambda = \frac{(6.626 \times 10^{-34}\,J\cdot s)(3.00 \times 10^{8}\,m/s)}{1.55 \times 10^{-19}\,J} = 1.28 \times 10^{-6}\,m$

$1.28 \times 10^{-6}\,m \left(\frac{1\,nm}{10^{-9}\,m}\right) = 1{,}280\,nm$

⇓

Infrared Radiation

(6)



1. +1
2. +2
3. -3
4. -2
5. -1

(7)

Ion	Co^{2+}	Al^{3+}	Li^{+}	NH_4^{+}
S^{2-}	CoS	Al_2S_3	Li_2S	$(NH_4)_2S$
ClO_3^{-}	$Co(ClO_3)_2$	$Al(ClO_3)_3$	$LiClO_3$	NH_4ClO_3
PO_4^{3-}	$Co_3(PO_4)_2$	$AlPO_4$	Li_3PO_4	$(NH_4)_3PO_4$
Br^{-}	$CoBr_2$	$AlBr_3$	$LiBr$	NH_4Br

(8)

(a) barium hydroxide
(b) dinitrogen tetroxide
(c) iron (III) nitrate
(d) potassium fluoride
(e) magnesium acetate
(f) nitrous acid (hydrogen nitrite)
(g) carbon tetrachloride

(9)

(a) $NaHCO_3$
(b) $AgNO_3$
(c) Cr_2S_3
(d) PI_3
(e) HCl
(f) $HClO_4$